JPRS 69665

23 August 1977

USSR

TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY
PHYSICAL SCIENCES AND TECHNOLOGY
No. 17

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BIBLIOGRAPHIC DATA SHEET	1. Report No. JPRS 69665	2.	3. Recipient's Accession No.

4. Title and Subtitle
TRANSLATIONS ON USSR SCIENCE AND TECHNOLOGY - PHYSICAL SCIENCES AND TECHNOLOGY No. 17

5. Report Date
23 August 1977

6.

7. Author(s)

8. Performing Organization Rept. No.

9. Performing Organization Name and Address
Joint Publications Research Service
1000 North Glebe Road
Arlington, Virginia 22201

10. Project/Task/Work Unit No.

11. Contract/Grant No.

12. Sponsoring Organization Name and Address
As above

13. Type of Report & Period Covered

14.

15. Supplementary Notes

16. Abstracts

The report contains information on aeronautics; astronomy and astrophysics; atmospheric sciences; chemistry; earth sciences and oceanography; electronics and electrical engineering; energy conversion; materials; mathematical sciences; cybernetics, computers; mechanical, industrial, civil, and marine engineering; methods and equipment; missile technology; navigation, communications, detection, and countermeasures, nuclear science and technology; ordnance; physics; propulsion and fuels; space technology; and scientists and scientific organization in the physical sciences.

17. Key Words and Document Analysis. 17a. Descriptors

USSR
Aeronautics
Astronomy
Astrophysics
Atmospheric Sciences
Chemistry
Computers
Cybernetics
Earth Sciences
Oceanography
Electronics
Electrical Engineering
Energy Conversion
Materials
Mathematics
Mechanical Engineering
Civil Engineering
Industrial Engineering
Marine Engineering
Methods
Equipment
Missile Technology
Navigation and Communications
Detection and Countermeasures
Nuclear Science and Technology
Ordnance
Physics
Propulsion and Fuels
Space Technology

17b. Identifiers/Open-Ended Terms

17c. COSATI Field/Group 01,03,04,07,08,09,10,11,12,13,14,16,17,18,19,20,21,22

18. Availability Statement
Unlimited Availability
Sold by NTIS
Springfield, Virginia 22151

19. Security Class (This Report) UNCLASSIFIED

20. Security Class (This Page) UNCLASSIFIED

21. No. of Pages 46

22. Price A03

FORM NTIS-35 (REV. 3-72)

THIS FORM MAY BE REPRODUCED

USCOMM-DC 14952-P72

JPRS 69665

23 August 1977

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CYBERNETICS, COMPUTERS, AND AUTOMATION TECHNOLOGY

ECONOMIC EFFECTS OF AUTOMATED CONTROL SYSTEMS

Tashkent PRAVDA VOSTOKA in Russian 24 May 77 p 2

/Article by M. Tsvifel', head of the division on the introduction of computer technology and control systems of Uzbek SSR Gosplan: "The Computer and the Economy"/

/Text/ At the 25th Party Congress the General Secretary of the CC CPSU, Comrade L. I. Brezhnev, stated the main economic problem facing our nation—improving the efficiency and quality of work in every way possible. Automated control systems (ACS's) present one solution to this problem.

In Uzbekstan in 1976 fifteen ACS's were put into operation—four in industrial sectors, nine in associations, enterprises, trusts, and organizations, and two in controlling manufacturing processes. During that year 14 computer centers were created, 28 modern computers were put into operation. Today the republic has operating 82 ACS's, 90 computer centers, and 286 computers.

The first phase of sector-wide ACS's were put into operation in the Ministries of the Food Industry, Installation and Special Construction Work, Highway Construction and Maintenance, and the Main Administration of the Gas Supply System (Glavgaz); ACS's are being used in pilot plants of the associations Uzbek Textile Machinery Manufacturers and Uzbek Cotton Machinery Manufacturers, by the Consumer Society's All-Union Trust for the Manufacture of Cotton Growing Machinery, the Chirchik transformer plant, the Tashkent oblast association Uzbek Selkhoztekhnika, and by other enterprises and organizations. An interdepartmental commission has started to operate the initial phase of an automated planning system for Uzbek SSR Gosplan—the first in the union republic's Gosplan system. The annual target for creating ACS's and introducing computer technology in the republic has basically been met. The economic savings realized by the introduction of these systems and computer technology is 12 million rubles a year.

But this figure alone does not exhaust the value of ACS's. Their chief effect has been to improve management, increase production efficiency, and substantially improve the qualitative indices of the operation of departments and enterprises. Thus, an optimum system of transporting compressed gas, which minimizes transportation costs and empty tank runs, was developed and tested as part of the first stage of the ACS of the republic's Glavgaz. Computers are planning deliveries from plants and suppliers to gas stations. The average tank turnover rate has been cut from 30 to 14 days. The new gas delivery system is realizing a savings of 1.9 million rubles a year.

The introduction of an ACS at the Tashkent Agricultural Machinery Plant has made it possible to eliminate all manually completed forms in the operational management of production. Management personnel have an opportunity to focus their attention on analyzing operations and effecting timely solutions. The coefficient of the plant's tempo of operations for the first ten-days of the month has risen from 0.67 in 1971 to 0.85 at the present time. While the volume of production rose over the Ninth Five-Year Plan by 46 percent, the number of administrative-management personnel has not changed. Due to increased reliability of data on the need for materials and purchases, excessive inventories have been reduced and the turnover on working capital cut from 47 days in 1972 to 40 days in 1976.

The Tashkent Aviation Production Association imeni Chkalov has increased its profits with the introduction of an ACS by 2.3 million rubles, and has substantially reduced its cost of materials and shop expenses.

The computer center of the Central Asian Railroad processes by computer, among other things, shipping and accounting records. The Tashkent Goods Accounting Office serves at 60 stations 4,300 enterprises and organizations, having accounts in 138 branches of Gosbank. All the commercial data of this office is processed by computer. Despite the fact that it has taken on the additional responsibility of servicing the Khavastsk division of the railroad and its volume of work has grown by 30 percent, the number of employees at the Office has not increased. Last year the computer processed the bills from which the railroad derived almost one-third of its income.

A highly efficient automated system for controlling the conveyance and shipment of ore is operating at the Kal'makyrsk Copper Mines of the Almalyksk Mining-Metalurgy Combine. The system serves 27 excavators, 10 tailing heaps, 10 railroad stations and sidings, 3 bins of an ore-

enrichment plant, and insures their coordinated operation. The operational solution of problems in planning internal exchanges and tracking loading and transportation equipment by computer has effected a 18 percent reduction in the time excavators must wait for transports.

The use of automated systems has also had excellent results at other enterprises. In particular, the experiment of the Tashkent Cable Plant, in which an ACS, for the first time in the republic, is solving the problems of automated control of the scientific-technical and social-economic development of a collective, deserves greater attention and emulation.

Increasing the productivity of computers is now under greater control. Contributing to the greater efficiency of computer use has been the use of existing computer centers by 359 enterprises and organizations which do not have their own computers.

The expansion of the computer center network and the total number of computers increases the need for personnel. A little more attention is being given to this problem than before. Last year specialized cybernetic departments of the republic's VUZ's trained four times as many specialists as in 1972, and the tekhnikums—3.6 times as many.

Experience has shown that in the majority of cases the effectiveness of an ACS and computer use depend on the operation supervisors and organizers. Rather than the programmers or operators, who run the computers, it is the supervisors, above all, who can and must present the ACS with the most important problems. This is the reason for the need to train them and enhance their experience and skills in using modern technology. The effort to raise the qualifications of supervisors in ACS's is being increased. Many production managers have undergone two month's training at institutes for improving the qualifications of supervisors, sponsored by the Uzbek SSR Council of Ministers. In Moscow, Leningrad, Minsk, Vil'nyus, Tashkent the skills of 452 computer center employees have been improved in programming new computers and in developing ACS's. Since 1976 the Tashkent Technical School No. 124 was first in the republic to start preparing computer personnel—operators, mechanics, and repairmen —for computer centers. In Tashkent was created the Administration of the All-Union Association of State Computer Trusts, assigned to assemble, install, and make computers operational, and to guarantee, maintain, and repair electronic computers.

Experience shows the ever increasing penetration of computers into the national economy, their wide use in realizing savings. Nevertheless, many shortcomings and mistakes have occurred in this important work. Not all ACS's are operating at the capacity they were intended, in particular, in the Ministries of the Meat and Dairy Industry, Construction, and in the Main Administration of the Timber Industry. In the Ministry of the Meat and Dairy Industry, for example, out of nine subsystems of an industry-wide ACS, installed in 1975, only five are operational. The first phase of the ACS of the Tashkent Dairy Combine is assigned five tasks, but is only performing two; at the Tashkent Meat Combine only two out of eleven tasks are being handled. This when the Ministry spent 1.3 million rubles to build these three ACS's. The Ministry of Construction spent 200,000 rubles on developing an ACS for the Fergansk Construction Trust No. 8, while the system goes unused. The ACS's in Trusts No 23 and Tashkent Oblast Rural Construction of the republic's Ministry of Rural Construction lie idle.

Several ministries and enterprises, having installed ACS's, are not recording their economic impact. The effectiveness of the ACS's does not appear in the 1976 records of the Ministry of Land Reclamation and Water Resources, Uzbek Selkhoztekhnika, Uzbek Main Administration of the Timber Industry, the association Navoiazot, the Tashkent Paint and Varnish Plant.

An effective means of speeding up the building of ACS's and reducing their costs is the standardization of designs, the use of existing plans of like ACS's. Unfortunately, these opportunities have yet to be widely exploited.

Serious shortcomings have been overlooked by individual ministries and departments in organizing the efficient use of computer technology. The pernicious practice still persists of acquiring computers without preliminary preparation of facilities, resulting in a lengthy period of inactivity. A computer, obtained for the Tashkent Computer Center, lay idle half a year due to a lack of facility preparedness. For the same reason the computer, acquired by the Tashkent Main Construction Administration at the end of 1975, was idle for 11 months. Due to a lack of preparation of facilities the computer in the Ministry of the Cotton Gin Industry is idle.

Nor have long computer shutdowns been eliminated during their operation. In 1976 two large computers of the republic's Ministry of Agriculture were idle from April to August due to gross violations of fire prevention rules in the computer room. Losses from the shutdown amounted to

240,000 rubles. The computer hardware at the Ministry of the Food Industry was idled for a long time. Computer time at the ministries of Construction, Rural Construction, Motor Transportation, the Civil Aviation Administration, and the Uzbek Main Administration of Construction Management fell short of the required load.

The application of computer technology to production is a key facet of scientific and technical progress, an important means to improve economic management. To a large extent production efficiency depends on the scale and quality of ACS's and computer use.

In the Tenth Five-Year Plan ACS's and computers are to be further exploited in the republic. More than 100 automated control systems are planned to be built. To further improve the efficiency of computer centers the policy has been adopted of creating computer centers for collective use. The largest of these will be the Tashkent Computer Center for Collective Use, whose construction begins this year.

A good deal of attention will be given to building ACS's for manufacturing processes, which yield a high return at minimal cost: their development will be 3.5 times greater than in the Ninth Five-Year Plan.

Automated control systems and computer technology have strengthened their foothold in the economy of Uzbekstan; they will become an important factor in improving the management of the republic's economy.

8506
CSO: 1870

AID FOR POWER ENGINEERS

Yerevan PROMYSHLENNOST' ARMENII in Russian No 4, 1977 pp 33,50

[Text] Problems of automating the control of power equipment and the operation of city, junction, regional, and other networks are important for developing electrical power and for decreasing losses. The development of an automated power control system is very important under these conditions.

The Armenian specialized department of the Order of the October Revolution All-Union State Institute "Energoset'proyekt" [All-Union State Planning, Surveying, and Scientific Research Institute for Power Systems and Electric Power Networks] is the main institute for developing automated distribution control systems (ADCS). The Yerevan investigators have completed the preparation of technical specifications for the ADCS for city networks. This development is included in the plan for the main measures under the new procedures of the USSR Unified Power System (UPS).

The topic "Calculations of Field Problems (Including Grounding Systems) for Rocky Soils" was also developed under the USSR UPS coordination plan. The Shaumyani substation was used as an example for the effective and economic solution of the grounding problem. It is proposed to replace the traditional deep electrodes, whose use required expensive drilling operations and did not provide the required characteristics, with a metal grid covered by a surface fill. Use of the grid system in rocky soils makes the grounding system simpler and cheaper for mountain electric stations and substations.

In Yerevan, a simulator for a 6-10 kilovolt city electrical network is becoming more and more popular with power operations engineers and investigators. The simulator has a wide range of uses. It can be used to determine the optimum division (break) points and for rapidly simulating emergency operating conditions, i.e. for determining the current and voltage conditions for cutting off the feed or distribution lines and points. Other simulator designs make it possible to represent the network system with visual mnemonics, which simplify finding the damaged link and switching rapidly to optimum new conditions for the operating network links. The Armenian specialized department of "Energoset'proyekt" has experimentally produced simulators according to the requests of many republics.

8773
CSO: 1870

UDC [681.3:658.012.011.56](479.25)

USE OF A SMALL NAIRI-2 COMPUTER IN AUTOMATED ENTERPRISE MANAGEMENT SYSTEMS

Yerevan PROMYSHLENNOST' ARMENII in Russian No 4, 1977 pp 34-35

[Article by P. A. Kyalyan and S. K. Khachaturyan, Candidates of Engineering Science, and B. K. Karapetyan, engineer]

[Text] Managing an enterprise efficiently and making it operate without interruption requires the circulation of a large flow of information--internal information between the subdivisions and external information between the enterprise and superior organizations and related organizations. The basic aspects of information activity--the collection and processing of documents--require a large amount of auxiliary operations. Monitoring is also required for the timely útilization of instructions, orders, directions, work schedules, etc. Even partial mechanization of these operations makes it possible to increase labor productivity and, what is most important, the quality of the work.

Automation of the main and time-consuming processes of management operations--reminders of performance periods and effective monitoring of the timely fulfillment of instructions--is becoming ever more widespread. Such a system is used in the Council of Ministers of the Armenian SSR and has been introduced into Minenergo [Ministry of Power and Electrification] USSR and in other departments. Existing systems and analogous systems that are being developed are for use with large Minsk-22 type computers, YeS [Unified System] computers, and others, which many departments do not have. Most enterprises have only small computers. Use of small computers to solve AEMS [Automated Enterprise Management System] problems would expand the use of AEMS subsystems, make AEMS available to many enterprises, and also free the expensive time on third-generation computers for solving more complex problems.

The possibility of using a small Nairi-2 type computer for facilitating production management has been studied in the Armenian specialized department of Energoset'proyekt [All-Union State Planning, Surveying, and Scientific Research Institute for Power Systems and Electric Power Networks] (ArmSO ESP). The ASKDN system (automated system for monitoring the performance of organizational and directional documents of the department on a Nairi-2 type

computer) has been created as one of the elements of the system that has been developed: "AMS [Automated Management System] for Planning Organizations." It has been shown possible to use the Nairi-2 computer to establish computer monitoring of organizational and directional documentation, leadership instructions, plan tasks,and schedules for planning, design, and other operations by preliminary reminders of performance periods and by noting the instructions that were not performed on time.

The system was used experimentally at ArmSO ESP and was put into constant operation. Operation of ASKDN confirmed its efficiency, simplicity, and reliability. It showed that ASKDN makes it possible to expand the scope and number of monitored instructions and to obtain reliable and timely information on the precision of the work done by the departments and by separate workers. ASKDN excludes the errors which are inherent to a human monitor and to the worker (carelessness, inattention, forgetfulness, and inaccuracy) and puts the workers under indirect social (as well as administrative) control. All this increased the standards and drive of management and the moral responsibility of the monitors and the workers. The Nairi-2 memory size allows simultaneous monitoring of the use of 750 documents. However, if the number of monitored instructions exceeds this number, they can be divided into groups and processed sequentially on the computer.

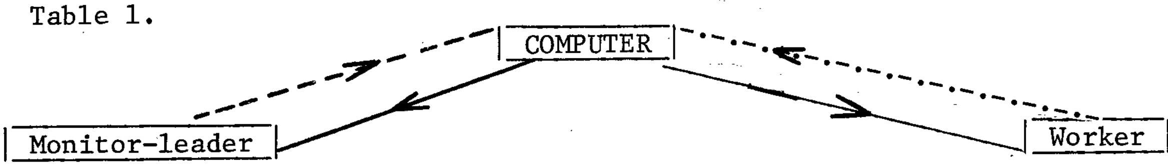
ASKDN can be used successfully also in many enterprises that have Nairi type computers. Without requiring additional operational and capital investment, ASKDN can become a reliable aid to production and can help increase the drive and standards of management.

ASKDN consists of three basic elements (Table 1): 1. The assigning element--the monitor-leader (the person who makes the assignments for the performance of the monitored work). 2. The memory element--the computer (the mechanical memory that remembers the period for performing the task, which provides reminders for timely performance, which notes the tasks that were not performed on time, and which analyzes the "quality" of the worker's performance). 3. The performing element--the worker: the department (worker) who performs the monitored instruction.

"Assignment coding forms" and "notification coding forms" serve as the documents to transmit information on the monitored instruction from the assigning and performing elements to the memory element.

"Monitor information forms" notify the leaders and the workers of approaching dates for completing the task and list the instructions which were performed late or which were not performed during the period. (At ArmSO ESP, the computer puts out monitor information forms on a weekly basis.)

Table 1.



--------------- Assignment coding form
-·-·-·-·-·-·-·- Notification coding form
——————————— Monitor information

Table 2.

Arm.SO ESP
MONITOR INFORMATION (weekly)

corre-spondent	document type	document index	date assign.	compl. date	worker	monitor
42i						
22-11-76						
1 instructions requiring reminders						
armglenup	letter	40321	01-09	26-11	p kyalyan	s khachaturyan
minenergo	order	12090	13-09	24-11	v saakov	s khachaturyan
2 instructions which are being performed late						
nos esp	direction	13402	20-10	20-11	g dul'yan	sh abranyan
3 instructions which are not being performed						
isu	report	45409	10-10	15-11	p kyalyan	v saakov

Table 3.

Arm.SO ESP
MONITOR INFORMATION (summary)

worker	total instruc. no.	performed late (in days) up to 10	up to 20	up to 30	total no.	%	instr. not performed no.	%
51i								
November 1976								
v saakov	8	0	0	0	0	0	1	12
g dul'yan	9	1	1	0	2	22	0	0
d sevoyan	10	2	0	1	3	30	0	0
p kyalyan	11	1	2	1	4	36	1	9

On Monday, the monitor-leader (the director, the chief engineer, the assistant director, the head of the technical department, etc.) uses an assignment coding form to instruct ASKDN to remind the worker of the date for completing the monitored instructions which must be performed during the current week.

The worker, who has been reminded by means of a monitor information form and completes the task, should take the monitored work from the ASKDN by notifying the computer operator of the completion by means of the notification coding form.

On the last day of the week, ASKDN analyzes the data available to it (which data were obtained by means of the assignment coding forms and notification coding forms) and outputs the results in the form of (weekly) monitor information forms (Table 2). On the forms, the computer prints information on how the controlled work is being completed and makes it possible for the leadership to monitor the assigned schedule for completing the work. If necessary, the leadership can take appropriate measures to have the task completed.

The computer prints the weekly monitor information in the form of three tables: 1. Instructions which require reminders. 2. Instructions which are being performed late. 3. Instructions which are not being performed.

Monthly and quarterly the computer analyzes the "work quality" of the workers for the period and prints the results in the form of a (summary) monitor information form (Table 3).

Here the computer shows the number of monitored instructions that were given to the worker during the month (or quarter), the number of instructions that were performed late (by 10, 20, and 30 days), and the number of incompleted instructions. The names of the workers who completed all the monitored instructions on time are not shown on the monitor information form.

8773
CSO: 1870

ELECTRONICS AND ELECTRICAL ENGINEERING

UDC: 621.374.351

INTEGRATING VOLTAGE CONVERTERS IN THE PHASE-SENSITIVE DETECTION MODE

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY -- PRIBOROSTROYENIYE in Russian No 5 1977 pp 5-10

[Article by E. K. Shakhov et al: "Integrating Voltage Converters in the Phase-Sensitive Detection Mode"]

[Text] This article examines the possibilities of employing integrating voltage-pulse frequency and duration converters in the phase-sensitive detection mode. It examines the filtering properties of converters of this type operating in synchronous detection mode. Recommendations are given on improving the selective properties of the synchronous detector on the basis of integrating converters.

Conversion of direct-current voltage is a traditional area of application of integrating voltage-time and voltage-pulse frequency converters. A more thorough study of the conversion relationships of devices of this type [1] indicates, however, that their functional capabilities make it possible substantially to broaden the area of their effective utilization. In particular, they can be employed in a phase-sensitive (synchronous) detection mode.

The author of [2], for example, proposes utilizing a voltage-pulse frequency converter for code conversion of the average rectified value of variable voltage. In execution by a voltage-pulse frequency converter of a conversion function of the type

$$f(t) = k|u_x(t)|$$

(k -- voltage-pulse frequency transfer factor) a result proportional to average rectified value $U_{x\ cp}$ can be obtained by calculating the output pulses of the voltage-pulse frequency converter (VFC) during an interval equal to or a multiple of period T_x of variable input voltage $u_x(t)$, that is,

$$N = \int_0^{T_x} f(t)\,dt = k\,T_x\,U_{x\,cp}.$$

It is not difficult to demonstrate that in order to achieve synchronous detection mode it suffices to reverse the direction of count of VFC output pulses at the proper moments in time in the process of this conversion. To clarify, Figure 1 shows a sine-wave input signal $u_x(t)$, its in-phase $u_{xc}(t)$ and quadrature $u_{xk}(t)$ components (that is, $u_x(t)=u_{xc}(t)+u_{xk}(t)$), while the dashed curve shows the corresponding law of change in VFC output frequency $f(t)=k|u_x(t)|$. It is evident from the figure that

$$N=\int_{t_0}^{t_1} f(t)\,dt-\int_{t_1}^{t_2} f(t)\,dt+\int_{t_2}^{t_3} f(t)\,dt-\int_{t_3}^{t_4} f(t)\,dt=$$
$$=kT_x(U_{x\,\text{cp}})_\text{c}=kT_xU_{x\,\text{cp}}\cos\psi,$$

where ψ -- phase shift angle of the converted voltage relative to its in-phase component, $(U_{x\ cp})_c$ -- mean rectified value of the in-phase component of the converted voltage. Thus, in order to achieve the effect of synchronous detection it is necessary to reverse the direction of count of the VFC output pulses at moments t_1, t_2 and t_3 in conformity with the signs contained in Figure 1.

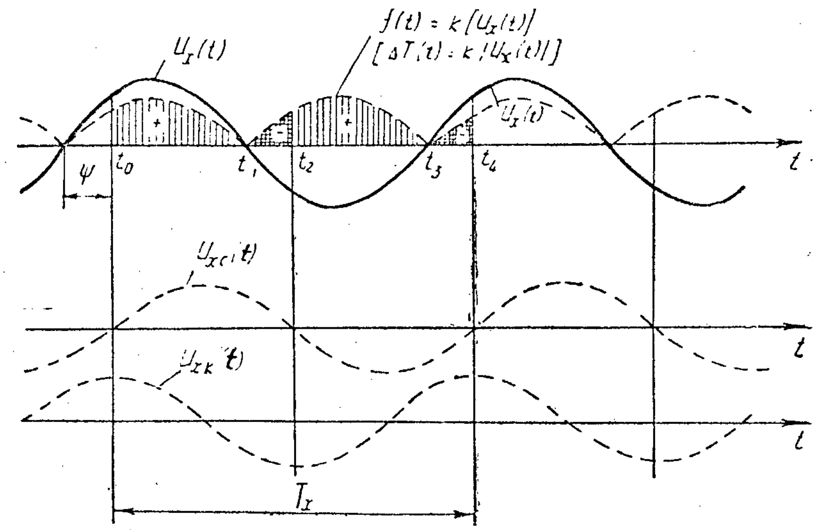


Figure 1. Time Diagram of the Operation of an Integrating Converter in Synchronous Detection Mode

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In like manner, in a voltage-time converter (VTC) [3], which has a conversion function of the type

$$\Delta T(t)=k|u_x(t)|,$$

the same effect is achieved by reversing (at specified moments in time) the direction of counting of pulses which fill in the sequential informative time intervals ΔT.

One advantage of the VTC and VFC as phase-sensitive detectors is a high degree of accuracy, since there are no switching elements in the voltage

conversion circuit; the effect of rectification is achieved by means of discrete devices.

The existence of integrating properties of VTC and VFC when utilized in synchronous detection mode gives reason to expect to obtain not only a detection effect but also an effect of filtration of parasitic components of the converted signal. A mathematical model of a VTC (VFC), operating in synchronous detection mode, was constructed in order to investigate this problem. The model is depicted in Figure 2, from which it is evident that output value Y(p) of the continuous part of the model (which reflects the filtering properties of the detector) constitutes the difference of current values of the function of the sliding integral from input value X(p) and that same function delayed in time by an interval equal to duration $T_Ц$ of the VTC (VFC) conversion cycle. In this case cycle duration $T_Ц$ is defined as the sum of elementary cycles $T_{ЦЭ}$ of VTC or VFC conversion, whereby $T_{цэ} \ll T_x$, while duration $T_Ц$ is assumed equal to one half the period of converted variable voltage, that is, $T_ц = \frac{T_x}{2}$. The pulse element at the output of the model has a period which is a multiple (in this case equal to doubled value) of the duration of the sum of an even number of cycles $T_Ц$. Thanks to this, adequacy of the model to the actual device in relation to rectification effect is achieved.

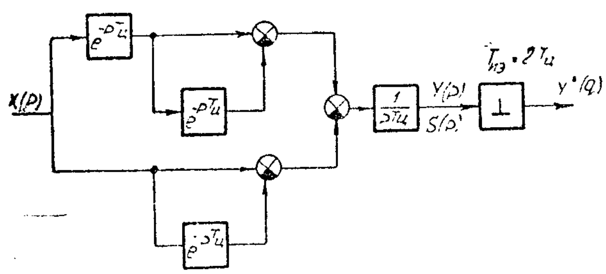

Figure 2. Mathematical Model of an Integrating Converter in Synchronous Detection Mode

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The transfer function and amplitude-phase characteristic (APC) of the continuous part of the model (Figure 2) has the form

$$S(p) = \frac{1}{pT_ц}\left[e^{-pT_ц}\left(1 - e^{-pT_ц}\right) - \left(1 - e^{-pT_ц}\right)\right] = \frac{1}{pT_ц}\left(1 - e^{-pT_ц}\right)^2;$$

$$S(j\bar{\Omega}) = \frac{1}{j\bar{\Omega}}\left(1 - e^{-j\bar{\Omega}}\right)^2,$$

where $\bar{\Omega} = \Omega T_ц$ -- relative frequency of converted signal change.

From the obtained expression, utilizing the Euler formula, we can easily obtain the modulus and argument of APC:

$$|S(j\bar{\Omega})| = \frac{2\sin^2 0{,}5\bar{\Omega}}{0{,}5\bar{\Omega}}; \tag{1}$$

$$\psi(\bar{\Omega}) = \operatorname{arctg}(\operatorname{ctg}\bar{\Omega}) = \frac{\pi}{2} - \bar{\Omega}.$$

The curve of the modulus of APC, plotted in conformity with (1), is shown in Figure 3 (designated as $|S_1(j\bar{\Omega})|$. It is evident from the figure that a VTC (VFC) in synchronous detection mode possesses certain filtration properties, but its sensitivity to components the frequencies of which are close to the frequencies of the fundamental harmonic and uneven harmonics of the useful detected signal remains sufficiently high. In addition, maximum sensitivity occurs not at the base frequency of the useful detected signal $\bar{\Omega}_{п}=\pi$, but at a frequncy in the order of $\bar{\Omega}=\frac{3}{4}\pi$. Therefore it is necessary to improve the selective properties of a synchronous detector based on a VTC (VFC).

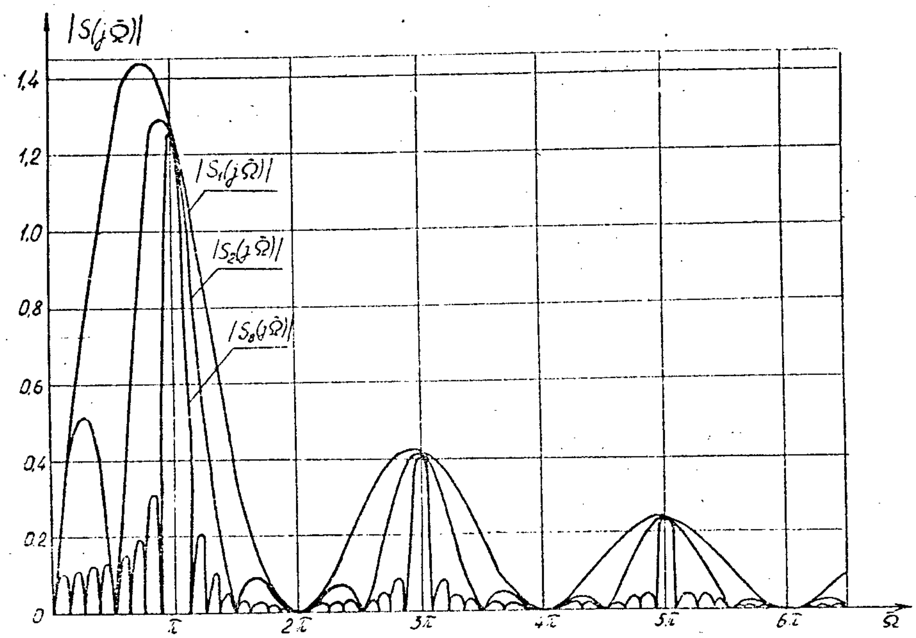

Figure 3. Graph of the Modulus of the Amplitude-Phase Characteristic of an Integrating Converter in Synchronous Detection Mode

As studies have shown, this problem is easily resolved with multiple adding of a number of sequential VTC (VFC) conversion results in synchronous detection mode. Figure 4 contains a corresponding mathematical model for 2^n-multiple adding. We should note that it is not difficult to construct a model for any additional multiple; in this instance preference has been given to the variant of 2^n-multiple addition for the sake of simplifying its mathematical description.

In the general case the transfer function and APC of the model have the form

$$S_{2^n}(p) = \frac{1}{pT_{\text{u}}}\left(1 - e^{-pT_{\text{u}}}\right)^2 \prod_{i=1}^{n}\left(1 - e^{-p2^iT_{\text{u}}}\right);$$

$$S_{2^n}(j\overline{\Omega}) = \frac{1}{j\overline{\Omega}}\left(1 - e^{-j\overline{\Omega}}\right)^2 \prod_{i=1}^{n}\left(1 - e^{-j2^i\overline{\Omega}}\right),$$

hence for the modulus and argument of the APC we shall obtain

$$|S_{2^n}(j\overline{\Omega})| = \frac{2\sin^2 0{,}5\overline{\Omega}}{0{,}5\overline{\Omega}}\, 2^n \prod_{i=1}^{n} \cos 2^{i-1}\overline{\Omega}; \qquad (2)$$

$$\psi_{2^n}(\overline{\Omega}) = \frac{\pi}{2} - 2^{n-1}\overline{\Omega}.$$

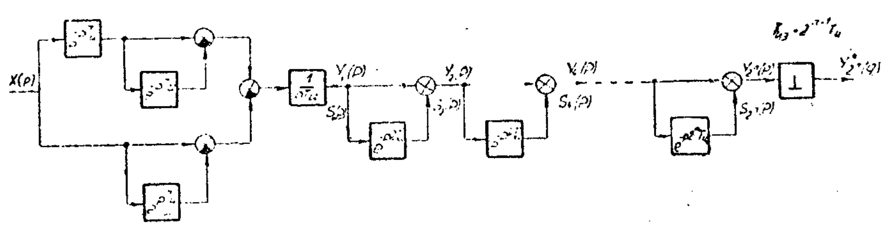

Figure 4. Mathematical Model of an Integrating Converter in Synchronous Detection Mode with Multiple Addition of a Number of Sequential Detection Results

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Figure 3 contains curves of relation (2) for instances of double and 8-fold addition. In addition, curves $|S_{2^n}(j\overline{\Omega})|$ are normalized, that is, reduced to the scale of curve $|S_1(j\overline{\Omega})|$, for which their values divided by 2^n are plotted on the axis of ordinates.

It follows from a comparison of these plots that addition of a series of sequential detector conversion results is an effective means of improving its selective properties in regard to useful detected signal. Sensitivity to the fundamental and uneven harmonics of the useful detected signal remains unchanged, while the total area under the curve of the modulus of the APC diminishes with increasing additions. Consequently by increasing the number of additions one can achieve the desired degree of suppression of parasitic components of the converted signal (naturally if this does not come into conflict with the requirement that a specified speed of response be secured).

Thanks to these properties of a synchronous detector based on a VTC (VFC), such devices can be extensively employed in performing diversified signal conversion tasks.

In developing a synchronous detector, the authors developed and experimentally examined a VTC the conversion cycle duration of which is 10^{-3} seconds, with relative calculated error not exceeding 0.01%, and maximum converted voltage -- 1 V.

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Manuscript received 9 September 1976

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CSO: 8144/1789

UDC 62-505.5:551.46.077

ON AUTOMATING THE CONTROL OF THE MOTION OF UNDERWATER TOWED SYSTEMS

Leningrad IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY-- PRIBOROSTRO-YENIYE in Russian No 12 1976 pp 34-39

[Article by O.S. Popov, O.A. Leont'yev, and B.V. Bruslinovskiy, Leningrad Electrotechnical Institute imeni V.I. Ul'yanov (Lenin), received 20 February 1976, recommended by the Department of Electrical Equipment and Ship Automation]

[Abstract] The authors propose a method for synthesizing motion control systems for towed devices used in oceanographic research. They present a block diagram of the system and a typical example of the transitional processes in the controlled spatial movement of the device.

[Text] Underwater towed systems are used extensively in oceanographic research. The basic element of such systems is the towed device (BA) that carries the complex of measuring instruments used to investigate the ocean. The amount and quality of the information obtained from the measuring complex always depends directly on how accurately the system's motion corresponds to the conditions for performing the work in the ocean. It is obvious that manual control of the BA's movements cannot provide highly accurate working conditions. Therefore, the problems involved in automating the control of the BA's motion have acquired particular importance. Different methods can be used in designing BA control systems. However, the analytical synthesis of the control process proves to be complete only when a quadratic functional is used. Let us mention here that problems of this nature correspond completely to the engineering nature of the problem of building BA control systems. However, the direct solution of this problem is beset with difficulties caused by the essential nonlinearity of mathematical models of the BA. The overall problem of determining the structure and parameters of the BA's control system can be simplified by using the method of sequential-hierarchical

synthesis [1]. In this method, all of the system's movements are divided into subsystems that are characterized by the different rates at which the processes take place, and each subsequent (faster) subsystem is investigated independently of the preceding one. Such a division is extremely typical for BA's, since every spatial movement of a BA can be represented by two types of motion that are fundamentally differentiated by the rate at which the processes take place: the movement of the BA's pole along a trajectory and the rotary movement of the BA around the pole.

Spatial movement of a BA is accomplished by a change in the magnitude and direction of the vector of the hydrodynamic force created by the device. In turn, the change in the hydrodynamic force vector is produced by changing the BA's angles of attack, yaw, and heeling with the help of vertical and horizontal rudders, as well as ailerons. Let us mention, however, that for an oceanographic experiment it is more advisable to have coordinated BA maneuvering; that is, motion with zero yaw angles.

Using the working conditions given in [2], a BA's spatial motion can be described by the nonlinear dynamic system

$$\dot{X} = AX + Z, \tag{1a}$$

$$\dot{Y} = BY + DU, \tag{1b}$$

$$Z = b\begin{pmatrix} 0 \\ \cos y_5 \\ 0 \\ -\sin y_5 \end{pmatrix} y_1, \tag{1c}$$

where

$$X = (x_1 x_2 x_3 x_4)',$$

$$Y = (y_1 \ . \ . \ . \ y_6)',$$

$$U = (u_1 u_2 u_3)',$$

x_1 = depth of the BA's pole's path; $x_2 = \dot{x}_1$ = vertical velocity; x_3 = coordinate of the BA's pole's lateral displacement; x_4 = = $\dot{x}_3$ = horizontal lateral velocity; y_1 = the BA's angle of attack; $y_2 = \dot{y}_1$ = rate of change of the angle of attack; y_3 = = the BA's yaw angle; $y_4 = \dot{y}_3$ = rate of change of the yaw angle; y_5 = the BA's heeling angle; $y_6 = \dot{y}_5$ = rate of change of the heeling angle; u_1, u_2, u_3 = angles of depth and direction rudders and ailerons, respectively; A, B, D = constant numerical matrices measuring 4 x 4, 6 x 6, and 6 x 3, respectively; b = = constant coefficient.

Subsystem (1a) describes the motion of the BA's pole along a trajectory in a terrestrial coordinate system that is related

to the towing ship's system, while subsystem (1b) describes the device's rotary motion around its pole.

Dynamic system (1) has the following special features:

1. The motion of the BA's pole along a trajectory and the BA's rotary motion are differentiated fundamentally by the rate at which the processes take place, with motion along the trajectory being the slower of the two. This makes it possible to decompose the entire dynamic system into subsystems according to levels of rapidity with which the processes occur. Equations (1a) and (1b) are such subsystems.

2. The trigonometric functions sin y_5, cos y_5 can take on any values from the entire range of change in the BA's heeling angle $y_5 \in [0;2\pi]$. This makes the linear description of the BA's dynamics impossible.

Let us formulate a problem: to determine the structure and parameters of the system of equations $U = U(X,Y)$, which insures the conversion of system (1) from the state $X(0)$ into the fixed state $X(\infty) = X_K$ providing that the basic functional is at its minimum:

$$J_1 = \int_0^\infty [(X - X_K)' Q_1 (X - X_K) + (Z - Z_K)' R_1 (Z - Z_K)]\, dt,$$

where Z_K = vector Z, corresponding to the right boundary condition of X_K (determined from the equations for steady-state conditions); Q_1, R_1 = weighted matrices.

Let us mention that the problem of controlling a moving BA is, as a rule, the problem of controlling its movement along a trajectory. The device's orientation must correspond to the physical principles of motion and also be subject to a number of additional conditions that are formulated when the problem is postulated. Therefore, by decomposing the system we will solve the problem in two stages [1]. During the first stage we formulate the BA orientation programs that unambiguously correspond to the given movement of the device's pole along a trajectory. In the second stage we look for an equation that insures the realization of the orientation programs that we have obtained.

Thus, the formulated problem is solved in the differential relationships (1a) that describe the system's slow movement. In this case, subsystem (1b) will be regarded as inertialess in comparison with subsystem (1a).

Solving the problem by the well known methods given in [3], we obtain first-level programmed control:

$$Z_{pr} = MX + NX_K, \tag{2}$$

where M = a constant numerical matrix, it being the case that N = -(M + A).

Let us represent expression (2) in the form

$$Z_{pr} = \begin{pmatrix} 0 \\ P_1(X, X_K) \\ 0 \\ P_2(X, X_K) \end{pmatrix}$$

Thus, we have obtained dynamic orientation programs for the BA that make it possible to compute the programmed values of the BA's angles of attack and heeling for all $t \in [0, \infty]$. To these programs we should add the condition that there is no yaw angle ($y_{3pr} = 0$). After some simple transformations -- allowing for (1c) -- we finally obtain:

$$\begin{cases} c\,[P_1(X, X_K)\cos y_{5pr} - P_2(X, X_K)\sin y_{5pr}] = y_{1pr}, \\ [P_1(X, X_K)\sin y_{5pr} + P_2(X, X_K)\cos y_{5pr}] = 0, \\ y_{3pr} = 0, \end{cases} \tag{3}$$

where c = a constant coefficient.

This concludes the first stage of the solution of the problem.

In order to realize programs (3), it is necessary to formulate the operator of the inverse relationships $U = U(X, Y, Y_{pr})$. It is obvious that an accurate realization of (3) is impossible under real conditions. Therefore, let us formulate the problem of synthesizing control as the problem of minimizing the auxiliary functional

$$J_2 = \int_0^\infty [(Y - Y_{pr})' Q_2 (Y - Y_{pr}) + (U - U_K)' R_2 (U - U_K)]\,dt$$

in differential relationships (1b) for boundary conditions $Y(0)$ and $Y(\infty) = Y_{pr}$.

Here we have adopted the following definitions: Y_{pr} = vector of the boundary conditions at the righthand point of the trajectory, as computed by relationships (3) in the form $Y_{pr} = (y_1, \ldots, y_6)'_{pr} = (y_1 0 y_3 0 y_5 0)'_{pr}$; U_K = control vector, corresponding to the right boundary condition of Y_{pr} (determined from the equations for steady-state conditions); Q_2, R_2 = weighted matrices.

During the solution of this problem, the righthand boundary condition must be regarded as fixed:

$$Y(\infty) = Y_{pr} = \text{const.}$$

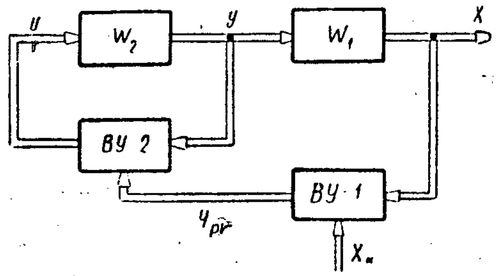

Figure 1. Block diagram of the control system.

As a result of the solution of the second problem we obtain

$$U = PY + LY_{pr}, \qquad (4)$$

where P, L = constant numerical matrices measuring 3 x 6.

Control laws (3) and (4) insure stable spatial movement of the BA for the given quality of the processes. Figure 1 depicts the structure of the synthesized control device, with the following definitions being used: W_1,W_2 = operators of subsystems (1a) and (1b), respectively; BY-1,BY-2 = computing systems realizing relationships (3) and (4).

The known uniformity of the mathematical models of the BA makes it possible to use this method in problems involving synthesizing the control of devices with different designs and purposes. The structures obtained here have monotypical content.

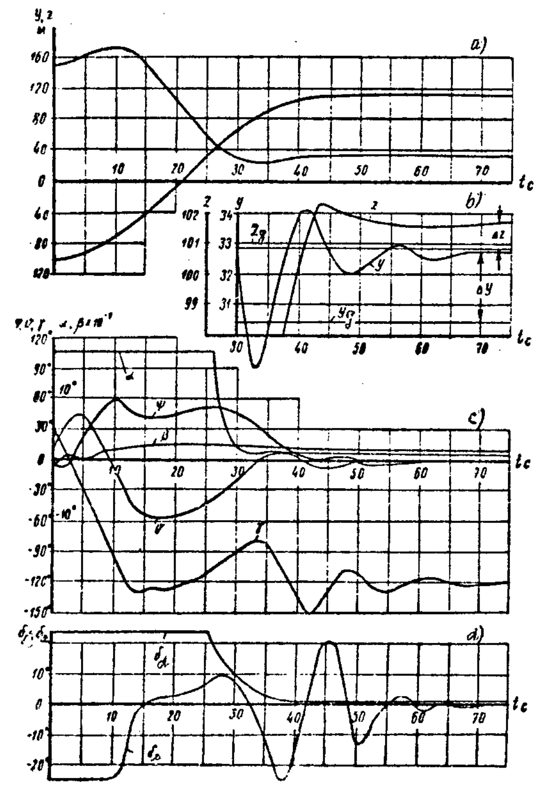

Figure 2. Transitional process in the system: y,y_g = = current and given values of the depth of the BA's path; z,z_g = current and given values of the BA's coordinate of lateral displacement; ψ,ϑ,γ = BA's yaw, trim, and heeling angles, respectively; α,β = BA's angles of attack and slip, respectively; δ_d,δ_e = angles of the depth rudders and ailerons, respectively.

The solution that we have found for the problem is not strictly optimal: the greater the difference between the rate of the intrinsic motions of subsystems (1a) and (1b), the closer the results correspond to a precise solution.

In order to solve these problems, we developed an ALGOL program for the computations. All stages of the designing of the BA control system are automated.

Figure 2 depicts a typical transitional process in a closed dynamic system characterized by the following natural parameters:

$$A=\begin{pmatrix} 0 & 1 & 0 & 0 \\ -9{,}3\cdot 10^{-3} & -0{,}35 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & -9{,}3\cdot 10^{-3} & -0{,}35 \end{pmatrix};$$

$$B=\begin{pmatrix} 0 & 1 & 0 & 0 & 0 & 0 \\ -8{,}9 & -7{,}38 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & -7{,}41 & -6{,}12 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & -4{,}85 \end{pmatrix};$$

$$D=\begin{pmatrix} 0 & 0 & 0 \\ 0 & 6{,}26 & 0 \\ 0 & 0 & 0 \\ 5{,}63 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 2{,}62 \end{pmatrix}.$$

The synthesized regulator has the following parameters:

$$M=\begin{pmatrix} -0{,}03 & -0{,}055 & 0 & 0 \\ 0 & 0 & -0{,}03 & -0{,}055 \end{pmatrix}; \quad N=\begin{pmatrix} 0{,}04 & 0 & 0 & 0 \\ 0 & 0 & 0{,}04 & 0 \end{pmatrix};$$

$$P=L=\begin{pmatrix} -0{,}32 & -0{,}042 & 0 & 0 & 0 & 0 \\ 0 & 0 & -0{,}34 & -0{,}053 & 0 & 0 \\ 0 & 0 & 0 & 0 & -2{,}24 & -0{,}41 \end{pmatrix}.$$

The precise technical realization of the control laws that we have obtained requires measurement of the coordinates $x_1,\ldots,x_4$ and $y_1,\ldots,y_6$, as well as performance of the operations of summation and sine-cosine transformation. Because of the insignificant deterioration of the quality indicators, it is usually possible to simplify the control laws. For example,

$$(y_2 y_4 y_6) \approx (\omega_z \omega_y \omega_x),$$

where $\omega_x, \omega_y, \omega_z$ = angular velocities of the BA's rotation around the related axes, as measured by angular velocity sensors.

There is no fundamental change in the synthesis procedure when the controls' time lag is taken into consideration. In this case, the appropriate group of equations should be added to system (1).

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KAZAKH SSR ACADEMY OF SCIENCES GENERAL ASSEMBLY SESSION

Proceeding of General Assembly Session

Alma-Ata VESTNIK AKADEMII NAUK KAZAKHSKOY SSR in Russian No 5, 1977 pp 3-4

[Text] The Kazakh SSR Academy of Sciences General Assembly Session was held on 6 April 1977 in the Grand Conference Hall of the Academy of Sciences; it was, as is customary, preceded by the annual assemblies of the departments, which discussed the results of the work of the academic establishments and heard a number of scientific reports.

The Presidium of the General Assembly consisted of Comrade D. A. Kunayev, member of the CPSU Central Committee Politburo and first secretary of the Kazakhstan Communist Party Central Committee, A. A. Askarov, S. N. Imashev, A. G. Korkin, and S. A. Smirnov, members of the Kazakhstan Communist Party Central Committee Bureau, and leaders of the republic's ministries and departments.

Opening the General Assembly, A. M. Kunayev, academician of the Kazakh SSR Academy of Sciences, corresponding member of the USSR Academy of Sciences, and president of the Kazakh SSR Academy of Sciences, recalled the severe losses which the Academy had borne since the previous General Assembly. Mikhail Izrailevich Korsunskiy, academician of the Kazakh SSR Academy of Sciences and eminent figure of science in the sphere of solid-state physics, died on 6 October 1976; Iskhak Takimovich Dyusembayev, corresponding member of our Academy and important scholar in the sphere of Kazakh literary studies died on 21 November; and Sergey Nikolayevich Bololyubskiy, corresponding member of the Kazakh SSR Academy of Sciences and important scientist in the sphere of comparative anatomy and animal morphology, died on 1 December.

Those assembled stood to honor the memory of the deceased scientists.

In his opening remarks A. M. Kunayev, president of the Kazakh SSR Academy of Sciences, raised fundamentally important questions concerning the Academy's further scientific and scientific-organizational activity.*

B. A. Tulepbayev, academician of the Kazakh SSR Academy of Sciences and vice president of the Kazakh SSR Academy of Sciences, reported on the prizes awarded by the Kazakh SSR Academy of Sciences in 1976.

The diploma of Ch. Ch. Valikhanov Prize Winner First Class was presented to the writer G. M. Musrepov, academician of the Kazakh SSR Academy of Sciences, for great services in the development of philological science.

The General Assembly participants heard a report from Ye. V. Gvozdev, corresponding member of the Kazakh SSR Academy of Sciences and acting vice president of the Kazakh SSR Academy of Sciences, on the activity of the Kazakh SSR Academy of Sciences in 1976.*

A. M. Kunayev, president of the Kazakh SSR Academy of Sciences, presented diplomas and prizes to a group of students for the best student work.

The Session heard the scientific report" The Problem of Materials' Radiation Damage Vulnerability in Connection With the Development of Nuclear and Thermonuclear Power Engineering"** delivered by Sh. Sh. Ibragimov, academician of the Kazakh SSR Academy of Sciences and vice president of the Kazakh SSR Academy of Sciences.

The following spoke in the debate on the summary report:* B. A. Zhubanov, S. K. Kenesbayev, and S. B. Balmukhanov, academicians of the Kazakh SSR Academy of Sciences, G. B. Pomerantsev and Sh. A.-G. Bolgozhin, corresponding members of the Kazakh SSR Academy of Sciences, Doctor of Chemical Sciences N. K. Nadirov, and V. M. Borovskiy, A. N. Ilyaletdinov, and A. B. Reznyakov, corresponding members of the Kazakh SSR Academy of Sciences.

The General Assembly approved the report on the activity of the Kazakh SSR Academy of Sciences in 1976 and adopted a decree on the activity of the Kazakh SSR Academy of Sciences in 1976.

Report by Kazakh Academy President

Alma-Ata VESTNIK AKADEMII NAUK KAZAKHSKOY SSR in Russian No 5, 1977 pp 5-10

[Report by A. M. Kunayev, academician of the Kazakh SSR Academy of Sciences, corresponding member of the USSR Academy of Sciences, and president of the Kazakh SSR Academy of Sciences]

* The texts of the reports and the speeches of the participants in the discussion of them are carried in this issue.

** The scientific report of Sh. Sh. Ibragimov, academician of the Kazakh SSR Academy of Sciences, will be published in the journal's No 6 issue.

[Text] Comrades!

The decisions of the 25th CPSU Congress assign a big and crucial role to science, which at the contemporary stage has become a most important means of the development of the production forces, increased production efficiency, and the increasingly full satisfaction of the Soviet individual's material and spiritual requirements.

The 14th Kazakhstan Communist Party Congress put a high value on the scientists' work, but, together with this, drew attention to the need for a comprehensive increase in the practical return from and a reduction in the time taken to introduce completed works.

The need for the intensification of science's ties to production, an improvement in the organization and an increase in the efficiency of scientific research, the complete and substantiated nature of recommendations which are put forward--these are the tasks which the party and government have set us.

The system and methods of controlling science at all levels of its organization play a role of paramount importance in enhancing the quality of scientific work. A key problem of such control is the planning of scientific studies and their introduction.

In the light of the decisions of the 25th CPSU Congress the USSR Academy of Sciences General Assembly pointed to the need for the organization of the target-program planning of research into the most important directions and problems of science which resolve the fundamental questions of scientific-technical progress in our country. The target program provides for carry-through planning: fundamental research-applied research-development-introduction in production. For this reason a most important task on which the Presidium, the departments, and the scientific establishments of our Academy have worked and will continue to work is the precise determination of the circle of questions being developed to whose solution we can make a substantial contribution, strict specialization of the scientific establishments, development of questions determining the level of development of the leading sectors of the republic's national economy, and concentration of material resources and scientific forces on the solution of only the most important fundamental questions.

The Presidium has determined 19 directions in accordance with which detailed comprehensive programs are being compiled, and the institutes, VUZ's, and establishments which are engaged in research in these directions are being enlisted in their development.

In the plane of accomplishment of the tasks set science by the 25th CPSU Congress the Academy has performed a great deal of work on an analysis and evaluation of the activity of all scientific establishments in the Ninth Five Year Plan and on the elaboration of measures to eliminate shortcomings mentioned by the commissions and has revised the subject range of scientific

research for 1977 and the period 1976-1980 for the purpose of consolidating the themes, concentrating forces on the most important work, and reducing the time taken for its implementation and introduction.

The prospective scientific problems of research for the period 1976-1990 providing for the development of the most important questions of science and technology have been specific and published, and a five-year plan has been compiled for out-of-town sessions of the Academy's General Assembly and departments in the major industrial regions of the republic.

In 1976--the first year of the 10th Five-Year Plan--which the 25th CPSU Congress defined as a five-year plan of efficiency and quality, our scientific research establishments performed work on 492 themes, 29 of which have been incorporated in the plan for the development of the Kazakh SSR national economy and 72 in the coordination plans and assignments of the USSR Council of Ministers State Committee for Science and Technology. Research into 31 themes has been completed. Experimental and experimental-industrial tests have covered 196 themes, and the introduction in the national economy of recommendations on 43 works has been completed. Some 117 author's certificates and 144 positive decisions were obtained, and 23 projects, including 44 inventions, were patented in the year under review. One licensing agreement was concluded.

In a comparatively short time the scientists of the Academy of Sciences have scored certain successes in the sphere of the fundamental sciences and have created original scientific directions and schools which have come to occupy a prominent place in Soviet science.

In the sphere of the physico-mathematical sciences such directions have evolved in the theory of differential equations and the theory of functions and functional analysis and in experimental physics of elementary particles, radiation physics of the solid state, direct conversion of thermal energy into electrical energy, semiconductor physics, activation analysis, solar, planetary, and solar-planetary link research, study of the structure and dynamics of the Galaxy, and extragalactic astronomy.

In the sphere of Earth sciences there is a high evaluation of such directions as metallogeny, geophysics, geochemistry, rock mechanics and seismology, hydrogeology, hydrogeothermy, the physical principles of the extraction processes of useful minerals, and glaciology.

The scientific directions in relation to the chemistry and technology of mixed concentrated fertilizer on the base of Karatau phosphorites, the synthesis of high-molecular compounds, oxidizing ammonolysis, the theory of catalytic hydrogenation and ligand catalysis, the theory and techniques of obtaining superpure metals, electrochemical methods of investigating catalytic agents, the catalytic processes of scrubbing harmful gases, the comprehensive processing of the Lisakovsk ores and polymetallic ores of Central Kazakhstan, the extraction of metals from the products of phosphorus

production, the theory and techniques of obtaining alumina, the physico-chemistry of lead-content systems, the principles of gallium metallurgy, and vacuum metallurgy are well known in the sphere of the chemical-technological sciences.

Research into the amelioration of soils, particularly alkali soils, regulation of the activity of the lymphatic and venous vessels, the physiology of digestion, the biosynthesis of protein and nucleic acids in plants, the republic's plant resources, the biological principles of the regulation of the strength of useful and harmful invertebrates, animal toxoplasmosis and rabidity, the physiology and biochemistry of microorganisms, the genetics and selection of microorganisms and viruses, the genetics and individual development of agricultural animals, and the introduction and acclimatization of plants could be put in the category of these important directions in the sphere of the biological sciences.

In the sphere of the social sciences such directions have taken shape in our republic as production economics and organizations, history of the Kazakh SSR, archaeology, problems of the theory of materialist dialectics, the development of state and law, the interlinkage of Kazakh literature and its history, popular art, and problems of the functioning and development of the Kazakh language.

The applied directions are also developing successfully in the Academy together with fundamental research. Calculus, the creation of various automated systems and scientific instruments and new analysis methods, obtaining superpure metals, and the search for new methods of treating useful minerals, methods and means of mechanizing labor-intensive operations, and labor-safety measures of automated mining systems of the planning of mines and the control of production engineering processes should be put in the category of the principal applied directions. Measures are being elaborated on the prevention of avalanches and mud slides and on the rational use of subterranean waters, including hot springs.

A process of the cyclone smelting of Karatau phosphorites on the bases of oxygen blowing has been introduced. Methods of obtaining smelted polyphosphates, protein-fats concentrates, and plant growth stimulants are being tested.

A number of new processes in the metallurgy of nonferrous and rare metals (lead, copper, rhenium, thallium, and cadmium) and new, more stable refractory materials and vacuum-thermal methods of processing concentrates and semifinished articles has been proposed and is being introduced.

New techniques of the production of amalgam luminescent lamps and a whole number of catalytic agents for gas purification and hydrogenation have been developed and introduced.

Chemical methods of ameliorating alkali soils and rational schedules for the use of sandy pasture have been elaborated and tested, and new rose strains, three types of dry bacterial leavens, and a method for the presowing flooding of rice paddies have been introduced.

A method of preparing toxoplasmic antigen has been proposed and defended by author's certificate. Measures have been elaborated with respect to the rational development and use of the saiga economy in the republic.

A new breed of Kazakh hybrid pigs and a new strain group of meat-wool semifine-fleeced sheep with the wool being of a crossbred character have been created.

This is, of course, a far from complete list of the practical work being performed in the interests of various sectors of the national economy. It is not difficult to see that all these developments ensue from or are a consequence of theoretical, fundamental research. And it is with good reason that it is said that there is nothing more valuable than sound theory.

The USSR Academy of Sciences General Assembly set scientists the task of developing fundamental research, which should have both weighty applied results and practical recommendations.

It is only possible to increase the efficiency of our research by combining fundamental and applied work. It is impossible to increase the efficiency of and returns from science without cognition of the new and without an outlet into practice. No less important in our work are new ideas and hypotheses enabling the scientist to find his own approach to and own viewpoint on the object of the research and obtain new results.

Following the experience of the Ukraine's Academy of Sciences, comprehensive scientific-technical programs are currently being compiled with respect to problems of nonferrous metallurgy, mining, catalysis, chemistry, geology, and the intensification of agriculture.

Such a form of science's ties to production as the contract on creative cooperation with interested enterprises and organizations has been considerably developed. In the year under review approximately 100 such contracts were drawn up by metallurgy and enrichment, organic catalysis and electrochemistry, chemical science, and mining institutes.

A most important factor of an increase in the efficiency of scientific work is the coordination and comprehensive nature of research. The 25th CPSU Congress drew attention to the increased role of the USSR Academy of Sciences as the center of theoretical research and the coordinator of all scientific work in the country. This task confronts our Academy in the republic. The activity of the scientific councils with respect to the most important problems and coordination and a comprehensive approach have been the object of the constant attention of the Presidium and the departments.

In the sphere of the natural and social sciences this work is being performed in the republic by 30 scientific councils, three commissions, and five academic councils of the institutes in which approximately 600 highly qualified scientists--academicians and corresponding members of the Kazakh SSR Academy of Sciences and doctors and candidates of sciences--participate.

Unfortunately, many councils are still exercising their functions in a formal manner and are exerting practically no influence on the shaping of comprehensive works.

Attaching great significance to effective coordination as a powerful factor of an increase in the efficiency of scientific research, the Presidium has devoted much attention to increasing the role and authority of the scientific councils.

In the year under review there were five enlarged conferences of chairmen and their deputies and academic secretaries of the scientific councils and of representatives of the Kazakh SSR Ministry of Higher and Secondary Specialized Education and of the Ministry of Education where information reports were heard from the chairmen of the activity of the scientific councils and on measures to improve the state of coordination and the comprehensive nature of scientific research.

The Presidium discussed the results of these conferences and adopted a decree in which it was recognized as being essential to considerably enhance the role of the scientific councils in the coordination of scientific work and galvanize their activity.

The fact that one-fourth of the themes being developed by the Academy is of a comprehensive nature points to an improvement in the state of coordination of scientific research.

The Kazakh SSR Academy of Sciences is participating in the fulfillment of assignments in relation to 22 program and coordination plans on the most important scientific-technical problems of the USSR Council of Ministers State Committee for Science and Technology. The institutes of metallurgy and enrichment and organic catalysis and electrochemistry are the head executives in relation to individual assignments of the USSR Council of Ministers State Committee for Science and Technology. The institutes of soil science, zoology, geological sciences, hydrogeology and hydrophysics, and seismology are conducting a large proportion of the research in acdorance with these programs.

A definite positive role in imparting a comprehensive approach to and in coordinating scientific research into the problems of the Aral' Sea and Lake Balkhash, diversion of part of the flow of Siberian rivers, and a reduction in the losses and comprehensive utilization of the republic's mineral resources should be played by the Kazakh SSR Academy of Science's Council for

the Study of Production Forces, the structure, tasks, and course of whose activity have been revised and approved. It only remains to initiate this work.

Together with the achievements that have been mentioned there are still many unsolved tasks and shortcomings in the activity of the Kazakh SSR Academy of Sciences' scientific establishments, particular against the backdrop of the new demands and the growing requirements of practice and of the rapid development of the republic's economy. The efficiency of scientific research, to which paramount significance is attached in our day, is linked in the closest way with its planning, coordination, and introduction. If one or other of these components is executed with insufficient precision, this is reflected in the efficiency of our work.

In its significance the planning of research represents the most important sector for the reason that it is at this stage that the foundations of future successes are laid and results are arrived at which in a few years will have to be introduced in production. For this reason insuring the comprehensive and continuous nature of scientific works and a reduction in potential gaps at the intersections of fundamental, exploratory, applied, and design-production engineering developments and also between them and the stage of industrial assimilation of their results will enable us to considerably increase the efficiency of scientific research.

Multiplicity of theme and the disconnected nature of subject matter have, unfortunately, still not been eradicated in our republic. We have scientific research works which are inadequately backed up by highly skilled scientific cadres and which are not provided with modern highly productive automated laboratory equipment and computers.

The scientific establishments are still too timid in becoming a part of the development of comprehensive programs along USSR Council of Ministers State Committee for Science and Technology and also republic national economic plan lines. Our lagging is most marked in such most important sectors of science as calculus, automation, electronics, problems of ferrous metallurgy, scientific instrument building, radiobiology, molecular biology, and biophysics.

The inadequate provision with equipment and the lack of their own experimental base are curbing the development of these modern directions of science and the testing and introduction of scientific developments.

Some 334 themes or 67 percent of the Academy's entire subject range were completed in 1974--the final year of the Ninth Five-Year Plan. This concentration is one of the shortcomings of our planning; at the end of the five-year plan the number of completed themes was approximately five-six times greater than in a conventional year. This circumstance is not as innocent as it may at first sight appear; it gives rise to an unwarranted overload on the academic councils and publishing houses and last-minute haste in the registration and discussion of reports, with all the ensuing consequences.

It might have seemed that if 334 themes were completed in 1975, we should have substantially increased our plan for introduction and experimental and industrial-testing verification in 1976. But this was not the case.

All this indicates that we are still paying insufficient attention to questions of introduction because on average only 10 percent of all completed operations yields a real practical return. Naturally, this figure cannot be made to grow to 100 percent--there may in all departments be theoretical work and research whose value cannot be assessed in terms of rubles--but 60-70 percent of the subject range should yield a real saving.

High efficiency of research may be achieved only when at all stages of work we operate with this basic criterion as the point of departure.

The foundations of high efficiency are laid right at the first stage--the planning of research. What is being planned today will be introduced in 3-4 years. And if today a topic becomes a part of the thematic plan without sufficient substantiation and calculations of real prevision of how it will turn out, we can hardly expect much benefit from it.

Clearly, in planning introduction the leaders of the scientific establishments must consider how much they will spend and how much they will yield up. Only institutes of a humanities caste may be absolved of such calculations. For all the others they are absolutely obligatory.

The shaping of target-program plans representing a unified organizational-integral complex should help in enhancing the quality of scientific research and experimental-design developments. This is the most expedient and promising approach under the conditions of varied departmental subordination of the scientific organizations. We must be more active and consistent in introducing the target-program method of planning research into the most important problems, underpinning it with the urgent provision of scientific cadres, monetary assets, and material resources. It is essential to enlist not only the Academy's scientific establishments and the VUZ's but also sectorial institutes and production organizations in the elaboration and fulfillment of these programs for the purpose of insuring a continuous work process from scientific exploration to introduction.

It is essential that we perform a great deal of work to completely free ourselves of petty subjects of little urgency for the purpose of concentrating forces and facilities on the fulfillment of fundamental research and the most important scientific-technical programs. This, naturally, will also demand fundamental structural reorganization.

We are confronted with very crucial work in the plane of increasing the efficiency and dimensions of the introduction of scientific developments insofar as we cannot be satisfied with the results to hand since the Academy's potential in the sphere of introduction is by the most modest estimates approximately 1.5-2 times higher. However, the successful

introduction of scientific achievements depends not only on the scientists but also on the production workers and on their degree of interest. It would be best, in our view, for the solution of these tasks for the academic institute's relations with the sectorial scientific research institute or enterprise to be organized ab initio on a contract basis, while for particularly important subjects their simultaneous inclusion in the plans of the Academy and corresponding departments would be the optimum.

We must coordinate and delineate more precisely the circle of questions under study within the framework of the Academy, VASKhNIL's Eastern Department, and the republic's sectorial institutes and VUZ's. The Academy of Sciences will work on the solution of these tasks in 1977. There is no doubt that the collective of the Kazakh SSR Academy of Sciences will fulfill the designs of the 25th CPSU Congress and 14th Kazakhstan Communist Party Congress, justify the high evaluation of the level of Kazakhstan science, and achieve high efficiency in its research.

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SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

REPUBLIC ACADEMY OF SCIENCES PROCEEDINGS REPORTED

New Members of Belorussian Academy

Minsk SOVETSKAYA BELORUSSIYA in Russian 10 Apr 77 p 3

/Text/ The family of members and corresponding members of the Belorussian SSR Academy of Sciences has been replenished with new representatives of Belorussian science.

At a session of the general meeting of the Belorussian SSR Academy of Sciences, L. V. Volod'ko (optics), R. I. Soloukhin (applied physics), R. G. Garetskiy (geology), and N. V. Birillo (linguistics) were elected academicians of the republic's Academy of Sciences and V. A. Pilipovich (quantum electronics), V. P. Gribkovskiy (theoretical physics), Ye. A. Ivanov (mathematics), V. V. Klubovich (applied physics), A. M. Shirokov (cybernetics), V. S. Soldatov (physical chemistry), Yu. M. Ostrovskiy (biochemistry), P. T. Petrikov (USSR history), and Ye. M. Babosov (theory of scientific communism) were elected corresponding members.

The session of the general meeting of the Belorussian SSR Academy of Sciences, in accordance with regulations of the Academy, approved the administrators of scientific institutions elected at general meetings of the departments of sciences.

A. T. Kuz'min, secretary of the Belorussian Communist Party Central Committee, and A. T. Korotkevich, head of the science and educational institutions section of the Belorussian Communist Party Central Committee, took part in the work of the session.

Latvian Academy Vacancies

Riga SOVETSKAYA LATVIYA in Russian 8 Apr 77 p 3

/Notice signed by A. Malmeyster, president of the Latvian SSR Academy of Sciences, and V. Samson, chief scientific secretary of the presidium of the Latvian SSR Academy of Sciences/

/Text/ The Latvian SSR Academy of Sciences, in accordance with sections 18 and 19 of the regulations, hereby issues notification of the vacancies for members (academicians) and corresponding members which exist in the following specialties:

	Members	Corresponding Members
Nuclear spectroscopy	--	1
Applied microbiology	1	1
Chemistry	1	--
Chemistry of natural compounds	--	1
Medicine	1	--
Agricultural economics	--	1
Philosophy	1	--
History of the CPSU	--	1
Lettish literature	1	--
Lettish language	--	1

Scientists who have enriched science with transactions of great scientific importance may be elected members (academicians) of the Academy of Sciences in accordance with section 14 of the regulations.

Scientists who have enriched science with important scientific works may be elected corresponding members of the Academy of Sciences in accordance with section 15 of the regulations.

The principal responsibility of members and corresponding members of the Latvian SSR Academy of Sciences, according to section 27 of the regulations, consists of enriching science with new achievements and discoveries by means of personally carrying out scientific research, organization of the collective elaboration of key scientific problems and scientific leadership in these efforts.

Members and corresponding members actively promote the introduction of scientific achievements into the national economy and their utilization in cultural construction, direct work in the training of scientific personnel and improvement of their skills, and carry out other assignments of the Academy of Sciences.

Councils of scientific institutions and higher educational institutions, state and public organizations, and members and corresponding

members of the Latvian SSR Academy of Sciences are granted the right to inform the Latvian SSR Academy of Sciences in writing within 1 month from the date of publication, with the appropriate justification, of the names of candidates for members and corresponding members of the Latvian SSR Academy of Sciences, in accordance with the specialties indicated in the publication (section 20 of the regulations).

In presenting candidates for members and corresponding members of the Latvian SSR Academy of Sciences, it is necessary to enclose the following materials (in triplicate): an autobiography, personnel record /lichnyy listok po uchetu kadrov/, a list of scientific transactions and testimonials on their importance to science and the communist construction of the USSR, a description of the candidate and his photograph (9 x 12 cm).

All the materials indicated are sent to the presidium of the Latvian SSR Academy of Sciences, 19 Turgenev Street, Riga, GSP /special city postal service/.

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A NEW FORM OF PLANNING MODERN SCIENTIFIC RESEARCH

Riga IZVESTIYA AKADEMII NAUK LATVIYSKOY SSR in Russian No 4, 1977 pp 3-5

[Article: "Complex Programs--A New Form of Planning Modern Scientific Research"]

[Text] The 25th CPSU Congress emphasized the tremendous role of Soviet science in solving problems of communist construction. The congress specified as basic tasks of science at the present stage continued expansion and intensification of investigation of the laws of nature and society, increasing the contribution of science to the solution of urgent problems in the creation of a material-technical base for communism, acceleration of scientific-technical progress and growth of efficiency of production, improving the well-being and cultural level of the people, formation of a communist viewpoint among workers.

A special emphasis was made on the need for raising the efficiency and quality of scientific research, improving the forms of communication between science and production, improving planning and financing of scientific research.

At the Latvian SSR Academy of Sciences, certain successes have been achieved in the planning and coordination of scientific research. The planning of the academy's research work is done in accordance with the basic directions of scientific research as worked out by the presidium of the Latvian SSR Academy of Sciences and approved by the USSR Academy of Sciences.

The main part of the scientific research of the Latvian SSR Academy of Sciences corresponds to the subject matter indicated in the "Basic Directions of the Development of the National Economy of the USSR for 1976-1980" approved by the 25th CPSU Congress. The further expansion and deepening of subject matter concerned with the natural and technical sciences are being planned along the following directions approved by the 25th CPSU Congress:

research in molecular biology;

research aimed at the broad and effective use of electronic computing equipment in the national economy;

research in hard-body physics, semiconductors and dielectrics for the purpose of creating structures for storage and processing of information;

research on the creation of materials with new properties;

research on magnetic hydrodynamics and electrodynamics for the purpose of developing new technology, apparatus, machines;

development of production of physiologically active compounds through chemistry and microbiology.

In the field of the social sciences, research is developing on the history of the victory of socialism in Latvia, protection of its gains and the building of a developed socialist society, on increasing the effectiveness of socialized production, as well as on the history and theory of culture and language.

The concentration of the scientific resources along the most important directions is guaranteed methodically by the employment of the program-goal principle of planning of scientific research. The use of the program approach raises the level of the comprehensiveness of planned research and its goal orientation.

The basic research of the Latvian SSR Academy of Sciences is planned according to 16 comprehensive programs. The aim of these programs is to achieve a certain level of knowledge of the investigated problems, to acquire new information, generalization, to discover principles of functioning, to work out models, methods of computation, new methods for technical solutions, as well as to obtain recommendations used in practice.

In accordance with the assigned set of goals, a system is being worked out for their achievements containing a complex of measures, resource and other indicators.

This number of programs is necessary and sufficient for purposeful planning of basic research corresponding to the scientific subjects indicated in the "Basic Directions of Development of the National Economy of the USSR for 1976-1980" approved by the 25th CPSU Congress, as well as in the basic directions of scientific activity at the academy's institutions that were approved by its presidium. The programs are headed by leading scientists--Academicians A.K. Malmeyster, A.A. Drizul, E.A., Yakubaytis, V.P. Samson, Yu.A. Mikhaylov and others.

In the context of coordination of research with the USSR Academy of Sciences, the above-mentioned important basic research comes under the basic comprehensive programs of the USSR Academy of Sciences as their parts.

Thus, for example, the program of the Latvian Academy of Sciences "Molecular Bases of Genetic Viral Infections" comes under the program of the AS USSR "Molecular Virusology" as a part of this program. The program of the Latvian SSR Academy of Sciences "Automation of Scientific Research on the Basis of a Computing System of Collective Use" is a part of the program of the AS USSR "Development of Computing Technology and its Use in the National Economy."

Most important scientific-technical problems on the scale of the USSR are being worked out according to programs approved by the State Committee for Science and Technology of the USSR Council of Ministers. Scientific institutions of the Latvian SSR Academy of Sciences are coperformers of 23 such programs.

The presidium of the Latvian SSR Academy of Sciences attaches much importance to the use of the scientific potential of the academy for the solution of scientific-technical problems of importance to the republic's national economy. Because of this institutes of the academy have been named head performers of the 6 most important republic comprehensive programs or their sections.

Republic comprehensive programs provide for the development and adoption of a comprehensive system of control of quality of industrial production, the creation of a republic automated control system, the solution of problems on the protection of nature and rational use of natural resources, the comprehensive use of peat deposits of the Latvian SSR, as well as the performance of other research and development of importance to the republic's national economy.

For the planning of adoption of the results of scientific research of the academy, 27 comprehensive programs are being developed relating to the most important research for the national economy. These programs provide for the solution of scientific-technical problems, performance of development in the interests of ministries, branches, associations and large enterprises of the country and republic. The objectives of the programs include development of new equipment, materials, the creation of new technological processes with subsequent transmission to specific enterprises. The programs define mutual obligations of academic institutes and enterprises of the national economy in regard to concrete developments and their adoption in production. In some cases, these programs are parts of larger comprehensive programs of basic research, the results of which are applied research or development.

On the program "Creation of New Semiconductor Instruments and Structures of Enhanced Quality," there are working jointly the Physico-Energetics Institute, the Institute of Electronics and Computing Technology, the Institute of Physics of the Latvian SSR Academy of Sciences, the Latvian State University imeni P. Stuchki, the Riga Polytechnic Institute and the Alpha Industrial-Technical Association.

The program developed by the Institute of Mechanics of Polymers of the Latvian SSR Academy of Sciences, the Institute of General and Inorganic Chemistry of the Armenian SSR Academy of Sciences, the Olayne Plant for Plastics Processing and the Razdan Mining Chemistry Combine provide for the creation and introduction of new materials based on polymers--filled and modified polyethylene and hardened glass-fiber plastic.

The main plan materials of the Latvian SSR Academy of Sciences are as before a plan of the most important scientific-research work coordinated by the academy and a plan of scientific-research work on scientific-technical problems.

At the same time the scope of the research in the comprehensive programs ensures greater purposefulness of work, permits better coordination of the research process, as well as experimental design work and their application in the national economy and the planning of all necessary interconnected measures.

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